

FINAL REPORT

GBI/EKV INTERCEPTOR ASSESSMENT

DASG60-90-C-0105

JULY 1990 THROUGH JANUARY 1995

DISTRIBUTION STATEMENT A

**Approved for public release
Distribution Unlimited**

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DTIC QUALITY INSPECTED 8

Submitted By:
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OFFICE OF THE UNDER SECRETARY OF DEFENSE (ACQUISITION & TECHNOLOGY)
DEFENSE TECHNICAL INFORMATION CENTER
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IN REPLY
REFER TO

2 APR 96

DTIC-OMI

SUBJECT: Distribution Statements on Technical Documents

TO:
PEO MISSILE DEFENSE
ATTN: SFAE-MD-NMD-SE-E (C DOBSON)
PO BOX 1500
HUNTSVILLE, AL 35807-3801

1. Reference: DoD Directive 5230.24, Distribution Statements on Technical Documents, 18 Mar 87.

2. The Defense Technical Information Center received the enclosed report (referenced below) which is not marked in accordance with the above reference.

GB1/EKV INTERCEPTOR ASSESSMENT DASC-60-90-C-0105, FINAL REPORT

3. We request the appropriate distribution statement be assigned and the report returned to DTIC within 5 working days.

4. Approved distribution statements are listed on the reverse of this letter. If you have any questions regarding these statements, call DTIC's Input Support Branch, (703) 767-9092, 9088 or 9086 (DSN use prefix 427).

FOR THE ADMINISTRATOR:

1 Encl

Crystal Riley
CRYSTAL RILEY
Chief, Input Support Branch

FL-171
Dec 95

DoD Directive 5230.24, "Distribution Statements on Technical Documents," 18 Mar 87, contains seven distribution statements, as described briefly below. Technical Documents that are sent to DTIC must be assigned one of the following distribution statements:



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(Reason)

(Assigning Office)

(Signature & Typed Name)

US ARMY PEO MISSILE DEFENSE - NMD
(Controlling DoD Office Name)

PO Box 1500; HUNTSVILLE, AL 35807
(Controlling DoD Office Address (City/State/Zip))

12 April 1996
(Date Statement Assigned)

FINAL REPORT

1. BACKGROUND

NAS was awarded a contract on 16 July 1990 to provide the U.S. Strategic Defense Command Ground Based Interceptor/EKV Project Office 13,881 Direct Productive Person Hours of support during the period from contract award through 15 January 1995. The requirement was for research and engineering assessments to help validate technology for a ground based, non-nuclear kill exoatmospheric interceptor. The original major objective of the requirement was assessment of interceptor design and test information in order to determine the most cost-effective technological approach. NAS was required to provide assessments of test plans and procedures, perform critical issue analyses, definition and resolution for the GBI development and demonstration program, as well as subsystem engineering analysis in the areas of lethality, survivability, architecture balancing, and life cycle engineering cost and risk analysis.

These efforts were required for the then ongoing Baseline Development, for analyses in support of National Security Directive 14, and in preparation for a Milestone II Decision Review. Extensive technological analysis was also envisioned for support of major annual reviews including Cost Analysis Improvement Group (CAIG) and the Defense Acquisition Board (DAB). The program at contract award included three (3) test flights for the Functional Technology Validation Program scheduled in FY 90 and FY 91 and approximately five (5) additional flights for the Experimental Test Bed scheduled for FY 93 through FY 94. Support was to be provided in accordance with the schedule provided in the Statement of Work, which envisioned a Milestone II Decision in the FY 94/FY 95 time frame.

2. FISCAL DATA:

The contract was for \$1.338M and 13,881 man-hours.

The amount expended as of 15 Jan 95 was \$922834 and 13,351mh.

Man-hours expended were broken out as follows:

Direct Labor	8371.25 mh
Consultants	1379.75 mh
Subcontracts	3600 mh

Analysis: While most of the direct productive person hours were expended, there was a significant amount of unexpended funds. The primary reason for this was major programmatic and schedule changes in the supported programs (ERIS and GBI). This caused a major change in the level of experience required for the requested support. The original plan was for very senior personnel with very specific expertise to provide support. With the programmatic changes these high labor rate individuals were not required and support was provided by more junior personnel. Also, in the original proposal, there was a significant amount of travel. This was to support flight testing, the majority of which did not occur. Approximately 28% of the unexpended funds are directly attributable to the reduced travel.

3. SUPPORT PROVIDED:

4. Assessment of Simulation and Test Plans and Procedures

We conducted technological assessments for the ERIS and GBI programs. Efforts included providing input and/or developing simulation and test requirements for presentation to the Test and Simulation Working Groups.

Examples of assessments in this area included:

Developed a Evaluation and Test Requirement Document (ETRD).

Developed test scenarios.

Developed flight test definitions.

Developed flight test requirement matrixes.

5. Development and Review of Range Requirements

We reviewed and provided recommendations on range requirements and schedules. This included analysis of Kwajalein test operations and procedures in support of the ERIS and GBI test programs and requirements.

Examples of tasks performed in this area include:

Coordination with the Kwajalein Safety Office on range safety issues such as certified round, operational destruct, and safe/arm requirement on the booster ignition train.

Reviewed and provided recommendation for the update of GBI Safety Directive 705-2038

6. Dem/Val Test/Target/Trajectory Support

We provided test planning services and support for the GBI PO which included trajectory documentation, reformatting and distribution as well as target assessments and rationale.

Flight test program definitions were developed and presented to the Evaluation Requirement Group.

Developed a plan for test requirements definition.

Developed a Requirements Traceability Matrix.

Conducted a study to define and recommend preferred impact areas.

7. Investigation of Selected Hardware Requirements

We provided review and technological analysis of selected hardware requirements for the ERIS/GBI/EKV programs. Support in this included review of specifications and interface control documents. Technical support was provided for working groups

design reviews and other technical reviews. Requirements were reviewed to insure producibility in accordance with best manufacturing practices.

Examples of the analysis produced include:

Evaluated transition of the Advanced Composite Net Molding Technology to production as it applied to GBI.

Reviewed the *NMD Technology Tracking Notebook* to compare with the technology programs that have been officially endorsed by the GBI PO.

Reviewed the *Monolithic Microwave Integrated Circuit (MMIC) Manufacturing and Processing* report to determine the applicability to GBI components.

The Theater High Altitude Area Defense Producibility Program Plan was reviewed for commonalty with the potential GBI design candidates.

Collected data for the GBI Producibility Technology Database. Information was gathered from sources such as the Silicon Hybrids for Infrared Extrinsic Detectors (SHIELD) program.

8. Ground and Flight Test Results

We conducted assessments of ground and flight test results to ensure that the appropriate critical issues were addressed. Inputs were provided to the appropriate working groups on the relevant issues.

9. Subsystem Engineering

We provided analytical support in the application of subsystem engineering and methodology to the GBI/EKV programs. Analyses addressed evolving capabilities and designs, interfaces with other Strategic Defense systems and subsystems, interfaces with system engineering and integration architecture; balancing activities, cost effectiveness, schedule, production, and deployment considerations.

Examples of the work performed include:

Developed a GBI Producibility Data Base.

Reviewed the GBI Technical Performance Measurement Plan and provided recommended improvements.

Prepared a historical summary on GBI Manufacturing Assessment Reviews.

Reviewed the BMW task database design.

Analyzed Ground Based Interceptor design risks.

10. Engineering/Cost Risk Analyses

A major portion of the effort was performed in this area. We developed Cost and Operational Effectiveness Analyses (COEA) to support several Milestones decision reviews as well as the day to "what if" exercises required to defend a major acquisition. To support these type efforts NAS developed the Cost Analysis Trade Study (CATS) model. This cost model application uses a spreadsheet frame work and is considered much more effective and efficient than other models such as PICES. CATS provides a much quicker response time for quick reaction studies, trade studies and "what if" exercises because the CATS model was specifically designed and structured to be responsive to engineering trade study applications. The input/output cycle is significantly reduced for CATS over other models. Results of trades can be obtained in near real time due to the architecture of the model. The model includes routines of time phasing and presentation of costs in various formats in either constant or escalated dollars. The model has been adapted to provide the detailed cost data sheets and favorable explanation sheets required for full DA PAM 11-5 documentation. The CATS documentation package is more personalized than other models performing similar functions and was used on several occasions to present data to the DoD Cost and Operational Analysis Improvement Group (CAIG) in support of Defense Acquisition Board (DAB) Milestone decision reviews on the GBI program. The CAIG found the presentations highly acceptable.

The CAIG was placing increased emphasis on cost estimate documentation to identify Cost Estimating Relationships (CER) source, database used and statistics

associated with CER development. In response, we added an additional format (in addition to the Cost Data Sheet and Variable Explanation Sheet) to the normal DA PAM 11-5 documentation to document the CER development. The CER Explanation sheet has greatly enhanced the understanding and acceptability of our cost estimates at the DA Cost and Economic analysis Center and the CAIG.

Risk Analysis is a key ingredient in the cost estimating process. Our cost analyst worked closely with the program management and technical personnel to develop the risk analysis as it impacted the cost estimates. Risk factors were developed and integrated into the cost estimating process that addressed cost schedule and technical risk. The CATS model used built in routines to generate high/low/most likely cost estimates and through central limit theorem procedures and statistical analysis to produce cost estimate bands with various confidence intervals. For a total risk analysis our cost analyst worked outside the model with the technical risk identification and abatement team to integrate technical and schedule risk components into cost risk.

Other examples of the work performed include:

Reviewed and made comments on draft GBI Risk Management Plan and Technical Performance Measurement Plan.

Prepared draft risk rating rationale for GBI producibility risks identified for the GPALS System Requirements Review.

Developed a GBI Risk Management Smart Book.

Prepared GBI Risk Management informational briefings.

Developed a GBI Risk Matrix.

Assessed the Technical Risk Assessment for Software Engineering system which was recently added to the BMP Program Manager's Work Station. Determined this tool will provide the capability to respond to top level software risk activity required by BMDO and ANMD PO actions.

11. Critical Issues Analyses

NAS performed technological assessments on GBI/EKV programmatic issues and provided the results to project personnel and various working groups. In most of the analyses we produced there were critical issues that had to be considered.

Examples of the work performed include:

Reviewed the BD Risk Database and recommended approval/disapproval of issues identified as being related to GBI. This activity required assessing approximately 35 issues and developing rationale for the recommendations.

Used the Technical Risk Identification and Mitigation System (TRIMS) software program to perform critical issues analysis.

Studied the benefits of the *Work Flow* software package. *Work Flow* would electronically automate the documentation and paper flow within the GBI PO and between its contractors. A system comparison of *Work Flow* to the current paper dominated procedures was performed. The study looked at cost savings, reduced transfer times, increased data storage and retrieval efficiency, and other tangible benefits that could be realized by the purchase of the *Work Flow* system.

Reviewed and commented on GBI Technical Performance Measurement Assessment Plan.

Developed a briefing Hazardous Material Program Planning for the EKV PO. The briefing discussed evolving DoD direction on how to incorporate environmental issues in the development and acquisition of weapon systems.

Analyzed and provided comments to the EKV Office. Regarding the ANMD ICWG GBI Endgame Shoutback issue.